Amazon Ecological Forecasting: Assessing the Relative Ecological Importance and Deforestation Risk of Unprotected Areas in Western Brazil Using Landsat 5 TM, CBERS 2B CCD, and NPP VIIRS

by

NASA DEVELOP – Langley Research Center

Maya Sankaran (Team Lead)

Christopher Carson

Allison Lanclos

Jessie Larson

Merna Saad

Cheryl Sevilla

Anthony Smith

SHOT – PPT SLIDE #1

PPT of Title.

“NASA Applied Science DEVELOP National Program

Langley Research Center

Summer 2012”

SHOT – PPT SLIDES #2-7

Community Concerns PPT

Slide 2: Picture of the rain forest. “Half of the world’s ecosystems will be destroyed or severely threatened over the next quarter century due to deforestation”

Slide 3: Picture of a forest burning. “200,000 acres of rain forest are burned every day.”

Slide 4: Pictures of rain forest animals. “Experts predict that 80-90% of tropical rain forest ecosystems will be destroyed by the year 2020.”

Slide 5: Pictures of indigenous people. “An estimated ten million indigenous people were living in the Amazon Rain forest five centuries ago. Today there are less than 200,000.”

Slide 6: Pictures of rain forest animals. “The rain forest is home to many species that are the last of their kind.”

Slide 7: Picture of sad chimp. “Experts estimate that we are losing 137 species each day due to deforestation…That equates to 50,000 species a year.”

EXT. SCENE. DAY. OUTSIDE NASA LANGLEY RESEARCH CENTER HEADQUARTERS BUILDING

SHOT – Flag poles outside headquarters building

SHOT – Sign on headquarters building

SHOT – In front of a tree by the headquarters building. Each student introduces themselves in front of the tree.

CHRIS

Hi, I’m Chris Carson and I’m a student at UC Berkeley.

ANTHONY

Hey, I’m Anthony Smith and I’m a student at Hanover High School.

JESSIE

Hi, I’m Jessie Larson and I’m getting my masters at Hampton University

CHERYL

Hi, I’m Cheryl Sevilla and I’m a student at Cal State Fullerton.

MERNA

Hi, I’m Merna Saad and I’m a recent graduate from Christopher Newport University.

ALLISON

Hi, I’m Allison Lanclos and a recent graduate from Southeastern Louisiana University.

MAYA

Hi, my name is Maya Sankaran and I am a student at the University of Virginia.

SHOT – Everyone in front of the headquarters building. Subtitle with project title.

EVERYONE

And we are the Amazon Ecological Forecasting Team!

INT. SCENE. DAY. – INTRO TO PROJECT INSIDE THE DEVELOP BUILDING AT LANGLEY AIR FORCE BASE

SHOT – Maya is sitting on a chair in the lobby of the DEVELOP building.

MAYA

The objectives of this project were to calculate NDVI using data from Landsat 5 TM and a Chinese-Brazilian satellite, CBERS 2B, to incorporate open source software, such as Quantum GIS…

SHOT – In the Amazon Ecological Forecasting room in the DEVELOP building. Zoom in on Merna and Allison working on a computer that displays the deforestation risk map. Zoom in on a computer showing VIIRS data.

MAYA (Voice Over)

…to create a deforestation risk map and a species richness map in order to propose future conservation units, to work with an underutilized sensor, VIIRS, and to model the future ecological niche of an endangered species in our study area.

SHOT – Video of computer screen using Google Earth. Zoom in on Rondônia with protected areas outlined in red.

CHRIS (Voice Over)

We focused our study on the unprotected areas of the Brazilian states of Rondônia and Amazonas. Protected areas are outlined in red. There are a number of endangered species in this region, as well as a proposed pipeline that would transport oil to other parts of the country.

SHOT - Anthony is standing in the lobby of the DEVELOP building.

ANTHONY

One of our collaborators is the Pimm Group, a research organization headed by Dr. Stuart Pimm of Duke University. Other potential partners include the UNEP-

WCMC, the Amazon Conservation team, and Brazil's space agency, the INPE. The INPE currently monitors deforestation using MODIS.

INT. SCENE. DAY. – METHODOLOGY/RESULTS/CONCLUSIONS INSIDE THE DEVELOP BUILDING AT LANGLEY AIR FORCE BASE

SHOT – PPT SLIDE #8 "NDVI"

SHOT – Cheryl is sitting in the DEVELOP Conference Room in front a computer with the NDVI time series displayed

CHERYL

In order to track deforestation in our study area, we created this NDVI time series to look at vegetation changes over time. Based on this, we were able to estimate that about 8% of the pristine forest in this area was destroyed between 2005 and 2011.

SHOT – Video of computer looking at GloVis, Quantum GIS and the Quantum GIS tutorial

CHERYL (Voice Over)

For the NDVI maps, we retrieved Landsat 5 TM images from GloVis, and processed them in Quantum GIS. We created this tutorial that explains the steps used to produce this product in Quantum GIS, which is open source software that can be used by small local communities and organizations to duplicate our methodology free of charge.

SHOT – Chris is sitting in the SatNet room of the DEVELOP building. A computer that is displaying CBERS data is in the background.

CHRIS

We also used the Chinese-Brazilian satellite, CBERS 2B. In addition to incorporating an underutilized sensor, The CBERS CCD has a higher resolution of 20 meters, as appose to Landsat's 30 meters.

SHOT – PPT SLIDE #9 “Risk Assessment Map”

SHOT - Merna is sitting in the DEVELOP Conference Room in front a computer with the Risk Map displayed

MERNA

We created a risk assessment map based on parameters such as proximity to roads, rivers, highways, and cities as well as the location of the proposed pipeline. Seen in red are areas highest at risk. Seen in black are areas where there is no forest, and therefore has no risk of deforestation. Using this map, areas were identified for enhanced deforestation monitoring and law enforcement.

SHOT – PPT SLIDE #10 “Species Richness Map”

EXT. SCENE. DAY. WALKING THROUGH THE WOODS BY THE GOLF COURSE ON THE LANGLEY AIR FORCE BASE.

SHOT – The camera follows Jessie walking through the woods. She stops and bends down to point out an insect on a leaf.

JESSIE

We created a mammal richness map data from the IUCN Red List. The Amazon Rain forest is one of the most biodiverse habitats in the world. It houses many endangered species such as mammals, amphibians, birds, and arthropods, such as this.

SHOT – PPT SLIDE #11 Image of mammal richness map

JESSIE (Voice Over)

As you can see, most endangered mammals are found on the border of Rondônia and Amazonas.

INT. SCENE. DAY. METHODOLOGY/RESULTS/CONCLUSIONS INSIDE THE DEVELOP BUILDING AT LANGLEY AIR FORCE BASE

SHOT – PPT SLIDE #12 "Ecological Niche Modeling"

SHOT - Allison is sitting in the DEVELOP Conference Room in front a computer with the ecological niche model data displayed

ALLISON

This model examines the habitat of *Ateles chamek*, an endemic primate species in our study area, for 2080 based on projected bio-climatic variables. In the future we would like to include biotics variables and use this data to prioritize areas for future protection.

SHOT – PPT SLIDE #13 "VIIRS"

SHOT – Video of computer screen with VIIRS tutorial being used to look at VIIRS data

JESSIE (Voice Over)

We also looked at VIIRS data. Here you see a demonstration using our tutorial to download the data from NOAA CLASS. We looked at things such as active fires and NDVI. We hope to update the INPE's DETER system, which uses MODIS to monitor illegal deforestation.

EXT. SCENE. DAY. – CONCLUSIONS/FUTURE WORK. BACK OUTSIDE THE NASA LANGLEY RESEARCH CENTER HEADQUARTERS BUILDING

SHOT - Allison speaking with flag poles in the background

ALLISON

With this project, we hope to show the ecological importance of the area and the risks associated with deforestation.

In the future we would like to incorporate the use of VIIRS and possibly look into future hydrocarbon

exploration, as well as investigate wildfires using hot pixels.

SHOT - Credits

CHRIS (Voice Over)

Thank you for watching our video. We would like to thank the following people for their support.

"Credits

Acknowledgements

Dr. Kenton Ross

Dr. Stuart Pimmm

Dr. Clinton Jenkins

Dr. Marion Adeney

Jason Jones

Dr. Miroslav Dudik

James Stewart

Nicholas Powell

Introductory Facts from:

"Rainforest Facts." *Raintree.* Raintree Nutrition, Inc., 11 May 2012. Web. 2 August 2012. <http://www.rain-tree.com/facts.htm>.

Music

"Quiet Rain" by onlymeith

//ccmixter.org/files/onlymeith/3386

"Inspire the People"

http://instrumentalsfree.com

"Opportunity Knocking"

http://www.royaltyfreemusic.com

References